

CLAIMS

I claim:

1 *Sub 1* 1. A punch and die alignment system, comprising:  
2 a first die including a first die aperture for  
3 receiving a punch;  
4 a second die including a second die aperture for  
5 receiving the punch;  
6 a first housing including a first die passage ~~for~~  
7 receiving at least a portion of the first die; and  
8 a second housing including a second die passage ~~for~~  
9 receiving at least a portion of at least one of the first  
10 die and the second die and *configured to permit* ~~permitting~~ at least one of the  
11 first die and the second die to rotate therein, thereby  
12 permitting the first die aperture and the second die  
13 aperture to be aligned with each other.

1 2. The punch and die alignment system according to  
2 claim 1, wherein the second die passage receives at least a  
3 portion of the second die and at least a portion of the  
4 first die.

1 *Sub 2* 3. The punch and die alignment system according to  
2 claim 1, wherein the second die passage *is configured to permit* ~~permits~~ at least the

3 first die to rotate therein.

1 4. The punch and die alignment system according to  
2 claim 1, further comprising:

3 a first alignment mark on the first die; and

4 a second alignment mark on the second die;

5 wherein alignment of the first alignment mark and the  
6 second alignment mark aligns the first die aperture and the  
7 second die aperture.

1 *Sub 3* 5. The punch and die alignment system according to  
2 claim 1, wherein the first die aperture and the second die  
3 aperture may be aligned to be concentric within about 5  
4 millionths of an inch.

1 6. A punch and die assembly, comprising:

2 a first die including a first die aperture for  
3 receiving a punch;

4 a second die including a second die aperture for  
5 receiving the punch;

*a* 6 a first housing including a first die passage ~~for~~  
7 receiving at least a portion of the first die;

*a* 8 a second housing including a second die passage ~~for~~  
9 receiving at least a portion of the second die and at least  
*a* 10 a portion of the first die and ~~permitting~~ *configured to permit* at least one of

11 the first die and the second die to rotate therein, thereby  
12 permitting the first die aperture and the second die  
13 aperture to be aligned with each other; and

14 a punch assembly including a punch extending through  
15 the first die aperture and the second die aperture during a  
16 punching operation.

1 7. The punch and die alignment system according to  
2 claim 6, wherein the second die passage receives at least a  
3 portion of the second die and at least a portion of the  
4 first die.

1 8. The punch and die alignment system according to  
2 claim 6, wherein the second die passage <sup>is configured to permit</sup> permits at least the  
3 first die to rotate therein.

1 9. The punch and die assembly according to claim 6,  
2 further comprising:

3 a first alignment mark on the first die; and

4 a second alignment mark on the second die;

5 wherein alignment of the first alignment mark and the  
6 second alignment mark aligns the first die aperture and the  
7 second die aperture.

10. The punch and die assembly according to claim 6,

2 wherein the first die aperture and the second die aperture  
3 may be aligned to be concentric within about 5 millionths of  
4 an inch.

1 11. ~~The punch and die assembly according to claim 6,~~  
2 *suba17* ~~further comprising:~~  
3 ~~a compression spring for biasing the punch in a~~  
4 ~~retracted position.~~

1 12. A method of aligning dies of a punch die assembly,  
2 the method comprising the steps of:  
3 inserting a punch into a punch receiving passage a  
4 first die; and  
5 aligning the punch receiving passage of the first die  
6 with a punch receiving passage of a second die by rotating,  
7 the first die with respect to the second die and attempting  
8 to advance the punch into the punch receiving passage in the  
9 second die to determine a location of the first die relative  
10 to the second die where the punch will experience a least  
11 amount of frictional forces from walls of the punch  
12 receiving aperture of the first die and the punch receiving  
13 aperture of the second die.

1 13. The method according to claim 12, further  
2 comprising the step of:

3            recording the relative positions of the first die and  
4            the second die after alignment of the first punch receiving  
5            passage and the second punch receiving passage by providing  
6            a mark on the first die and the second die.

1            14. The method according to claim 12, further  
2            comprising the steps of:

3            inserting the second die into a die receiving passage  
4            in a first housing; and

5            inserting at least a portion of the first die into the  
6            die receiving passage in the first housing.

1            15. The method according to claim 12, further  
2            comprising the step of:

3            selecting the first die and the second die for  
4            rotational alignment prior to aligning the first punch  
5            receiving passage and the second punch receiving passage.

1            16. The method according to claim 14, further  
2            comprising the step of:

3            selecting the first housing such that the first die  
4            will snugly fit into the die receiving passage.

1            17. The method according to claim 16, wherein the  
2            first housing is selected such that the first die and the

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3 die receiving passage in the first housing are concentric to  
4 within less than 10 millionths of an inch.

1 18. The method according to claim 12, wherein the  
2 first punch receiving passage and the second punch receiving  
3 passage are aligned to be concentric to within about 5  
4 millionths of an inch.

1 19. The method according to claim 14, further  
2 comprising the steps of:  
3 arranging a second housing on the first die; and  
4 arranging a punch assembly onto the second housing,  
5 inserting a punch into a punch receiving passage in the  
6 first die.

1 20. The method according to claim 19, further  
2 comprising the step of:  
3 arranging a compression spring on the punch to bias the  
4 punch in a retracted position after arranging the punch  
5 assembly on the second housing.

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